Thanksgiving 2018

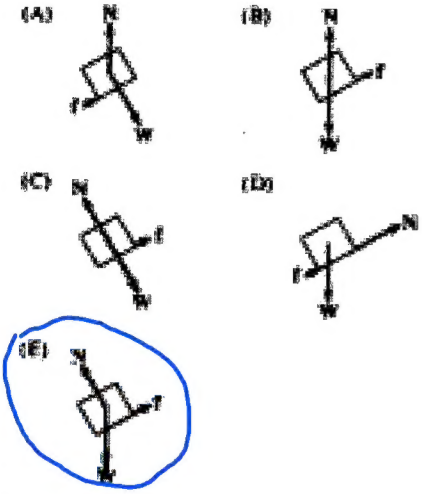
1) A 2-kilogram block slides down an incline as shown above with an acceleration of 2 meters per second squared.

$mg\sin\theta - ma$

The magnitude of the frictional force along the plane is most nearly

(a) 2.5 N (b) 5 N (c) 6 N (d) 10 N (e) 16 N

2) Which of the following diagrams best represents the gravitational force W, the frictional force f, and the normal force N that act on the block?



3) When a person stands on a rotating merry-go-round, the frictional force exerts on the person by the merry-go-round is

(a) greater in magnitude than the frictional force exerted on the person by the merry-go-round

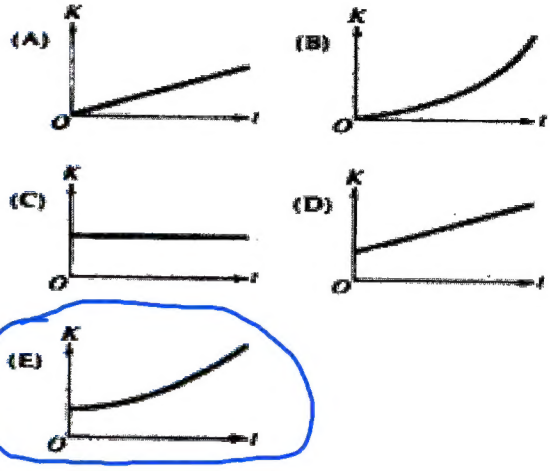
(b) opposite in direction to the frictional force exerted on the merry-go-round by the person

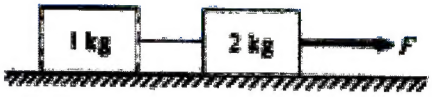
(c) directed away from the center of the merry-go-round

(d) zero if the rate of rotation is constant

(e) independent of the person's mass

4) From the top of a high cliff, a ball is thrown horizontally with initial speed v_o Which of the following graphs best represents the ball's kinetic energy X as a function of time t?





5) When the frictionless system shown above is accelerated by an applied force of magnitude F, the tension in the string between the blocks is

(a) 2F (b) F (c) 2/3 F (d) 1/2 F (e) 1/3 F

5. A ball of mass m is suspended from two strings of unequal length as shown above. The tensions T_1 and T_2 in the strings must satisfy which of the following relations?

(a) $T_1 = T_2$ (b) $T_1 > T_2$ (c) $T_1 < T_2$

(d) $T_1 + T_2 = mg$ (e) $T_1 - T_2 = mg$

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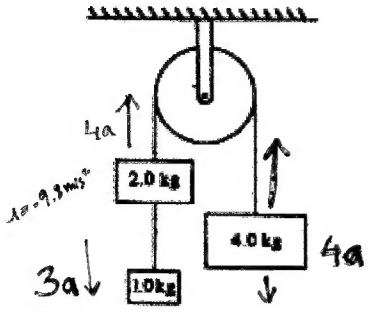


6) Three blocks of masses 1.0, 2.0. and 4.0 kilograms are connected by massless strings, one of which passes over a frictionless pulley of negligible mass, as shown above. Calculate each of the following.

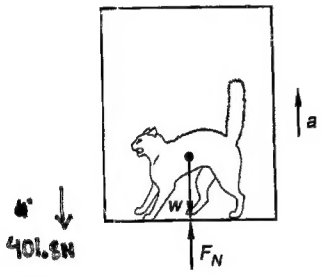
(a) The acceleration of the 4-kilogram block $a = \frac{(4-3)\cdot 9.81}{(4+3)} = 1.4\ m/s^2$

(b) The tension in the string supporting the 4-kilogram block 33.6 N

(c) The tension in the string connected to the 1-kg block 11.2 N

$3a:\ T - 3g = 3a$
$4a:\ 4g - T = 4a$
$g = 7a$
$\frac{9.8}{7} = a.$
$4(9.8) - T = 4(1.4)$
$\Rightarrow T = 33.6\ N$

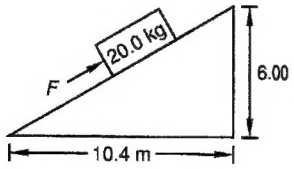
$T - mg = ma$
$T - 9.8 = 1.4$
$\therefore T = 11.2\ N$



7) A wildcat known as Fluffy whose mass is 41 kg is riding in an elevator. The elevator has a vertical upward acceleration of 2.1 meters per second per second. Find the apparent weight of the cat. Fluffy continues upward at a regular rate of speed. What is his new apparent weight?

$41(9.8+2.1) = 487.9\ N$
$41(9.8) = 401.8\ N$

8)



A 20-kg block is pushed slowly to the top of a frictionless inclined plane that is 6 m tall.

a) What is the angle of the incline? 29.98°
b) What is the force needed to push the block up the incline?

$\tan^{-1}\left(\frac{6}{10.4}\right) =$

$F = mg\sin\theta$
$= 20(9.8)\sin(30)$
$= 10(9.8)$
$= 98\ N$

c) What is the force needed to give the block an acceleration of 2.5 m/s^2? $mg\sin\theta + ma = 98 + 50 =$ 148N
d) What is the force of friction if the coefficient of kinetic friction (μ) is .34? $Normal = mg\cos\theta = 173\ N$
e) What is the force needed on the frictional surface to acquire an acceleration of 2.5 m/s^2? $F_f = \mu \cdot F_N = 0.34 \cdot 173 = 57.7\ N$

$148 + 57.7\ N = 205.7\ N$